

CLAIMS

What is claimed is:

1. A computer network backup system comprising:
 - at least two backup devices;
 - at least one file source;
 - a control unit comprising a control program that directs files from said file source to said backup devices, wherein said control program splits files into file segments, thereby equalizing the archival load between said backup devices;
 - a communications link coupled between said backup devices, said file source and said control unit.
2. The system of claim 1, wherein said backup device a hard disk, an optical disk, a magnetic tape drive or a non-volatile random access memory.
3. The system of claim 1, wherein said backup devices are geographically distributed.
4. The system of claim 1, wherein said file source is a storage device, a hard disk, a random access memory, a programmable non-volatile memory, a redundant array of independent disks (RAID), incremental backup data, snapshot data, a file system, a distributed file system or a location independent file system.

5. The system of claim 1, wherein said file source is comprised of at least two independent file sources.

6. The system of claim 1, wherein said communications link is a local area network (LAN), a wide area network (WAN), a peripheral component interconnect (PCI) or an InfiniBand.

7. The system of claim 1, wherein the protocol of said communications link is Ethernet, Internet protocol (IP) or asynchronous transfer mode (ATM).

8. The system of claim 1, wherein said control program calculates a file size segmentation threshold value.

9. The system of claim 8, wherein said segmentation threshold value is calculated by summing the sizes of all files in said file source and dividing the result by the number of said backup devices.

10. The system of claim 8, wherein said control program:
splits files that exceed said segmentation threshold value into file segments, wherein each of said file segments does not exceed said segmentation threshold value;

sorts files located in said file source and said file segments into a sorted list; and

writes files smaller than said segmentation threshold value and said file segments into said backup devices according to said sorted list.

11. The system of claim 10, wherein said files and said file segments are sorted in descending order based upon file size.

12. The method of claim 10, wherein said files and said file segments are sorted in ascending order based upon file size.

13. The system of claim 1, wherein said control program receives notification of backup device failure.

14. The system of claim 13, wherein said control program redirects said files and said file segments not already backed up on said failed backup device to at least one operative backup device.

15. The system of claim 14, wherein said control program balances the load between the remaining operative backup devices.

16. The system of claim 10, wherein said control program writes said files and said file segments to the then least filled-up backup device.

17. The system of claim 10, wherein said control program attaches a header to each of said file segments.

18. The system of claim 17, wherein said file segment header comprises at least one of an offset field or a size field.

19. The system of claim 8, wherein control program:
sorts files located in said file source into a sorted list;
writes files smaller than said segmentation threshold value into said backup devices according to said sorted list;
splits files larger than said segmentation threshold value into file segments according to space remaining in each of said backup devices; and
writes said file segments onto said backup devices.

20. The system of claim 19, wherein said files and said file segments are sorted in descending order based upon file size.

21. The system of claim 19, wherein said files and said file segments are sorted in ascending order based upon file size.

22. The system of claim 19, wherein said control program attaches a header to each of said file segments.

23. The system of claim 22 wherein said file segment header comprises at least one of an offset field and a size field.

24. The system of claim 19, wherein said control program writes said files and said file segments to the then least filled-up backup device.

25. A method for file backup using a parallel backup system comprising at least one file source and at least two backup devices, the method comprising:

calculating a segmentation threshold value; and

directing said files from said file source to said backup devices.

26. The method of claim 25, wherein said backup system is distributed.

27. The method of claim 25, wherein said backup system is geographically distributed.

28. The method of claim 25, wherein said file source a storage device, a hard disk, a random access memory, a programmable non-volatile memory, a redundant array of independent disks (RAID), an incremental backup data, a

snapshot data, a file system, a distributed file system or a location independent file system.

29. The method of claim 25, wherein said segmentation threshold value is calculated by summing the sizes of all files in said file source and dividing the result by the number of said backup devices.

30. The method of claim 25, wherein the method further comprises:
splitting files that exceed said segmentation threshold value into file segments, wherein each of said file segments do not exceed said segmentation threshold value;

sorting files located in said file source and said file segments into a sorted list; and

writing files smaller than said segmentation threshold value and said file segments into said backup devices according to said sorted list.

31. The method of claim 30, wherein the method further comprises attaching a header to each of said file segments.

32. The method of claim 31, wherein said file segment header comprises at least one of an offset field or a size field.

33. The method of claim 30, wherein the method further comprises sorting said files and said file segments in descending order based upon file size.

34. The method of claim 30, wherein the method further comprises sorting said files and said file segments in ascending order based upon file size.

35. The method of claim 30, wherein the method further comprises concurrently writing said files and said file segments to said backup devices.

36. The method of claim 35, wherein the method further comprises writing said files and said file segments in accordance with their ordered position in said sorted list.

37. The method of claim 30, wherein the method further comprises writing said files and said file segments to the then least filled-up backup device.

38. The method of claim 25, wherein the method further comprises:
sorting files located in said file source into a sorted list;
writing files smaller than said segmentation threshold value into said backup devices according to said sorted list;
splitting files larger than said segmentation threshold value into file segments according to space remaining in each of said backup devices; and
writing said file segments onto said backup devices.

39. The method of claim 38, wherein the method further comprises sorting said files and said file segments in descending order based upon file size.

40. The method of claim 38, wherein the method further comprises sorting said files and said file segments in ascending order based upon file size.

41. The method of claim 38, wherein the method further comprises concurrently writing said files to said backup devices.

42. The method of claim 38, wherein the method further comprises concurrently writing said file segments to said backup devices.

43. The method of claim 41, wherein the method further comprises writing said files in accordance with their ordered position in said sorted list.

44. The method of claim 38, wherein the method further comprises splitting files larger than said segmentation threshold value to file segments according to space remaining in said backup devices.

45. The method of claim 44, wherein the method further comprises attaching a header to each of said file segments.

46. The method of claim 45, wherein said file segment header comprises at least one of an offset field and a size field.

47. The method of claim 38, wherein the method further comprises writing said files and said file segments to the then least filled-up backup device.

48. A computer software product for a parallel backup system comprising at least a file source and at least two backup devices, the computer program product comprising:

software instructions for enabling said parallel backup system to perform predetermined operations, and a computer readable medium bearing the software instructions, said predetermined operations comprising:

calculating a segmentation threshold value; and

directing said files from said file source to said backup devices.

49. The computer software product of claim 48, wherein said backup system is geographically distributed.

50. The computer software product of claim 48, wherein said predetermined operations calculate said segmentation threshold value by summing the sizes of all files in said file source and dividing the result by the number of said backup devices.

51. The computer software product of claim 48, wherein said predetermined operations further comprise:

splitting files that exceed said segmentation threshold value into file segments, wherein each of said file segments do not exceed said segmentation threshold value;

sorting files located in said file source and said file segments into a sorted list; and

writing files smaller than said segmentation threshold value and said file segments into said backup devices according to said sorted list.

52. The computer software product of claim 51, wherein said predetermined operations further comprise attaching a header to each of said file segments.

53. The computer software product of claim 52, wherein said file segment header comprises at least one of an offset field and a size field.

54. The computer software product of claim 51, wherein said predetermined operations sort said files and said file segments in descending order based upon file size.

55. The computer software product of claim 51, wherein said predetermined operations sort said files and said file segments in ascending order based upon file size.

56. The computer software product of claim 51, wherein said predetermined operations further comprise concurrently writing said files and said file segments to said backup devices.

57. The computer software product of claim 51, wherein said predetermined operations further comprise writing said files and said file segments in accordance with their ordered position in said sorted list.

58. The computer software product of claim 51, wherein said predetermined operations further comprise writing said files and said file segments to the then least filled-up backup device.

59. The computer software product of claim 48, wherein the predetermined operations further comprise:

sorting files located in said file source into a sorted list;

writing files smaller than said segmentation threshold value into said backup devices according to said sorted list;

splitting files larger than said segmentation threshold value into file segments according to space remaining in each of said backup devices; and

writing said file segments onto said backup devices.

60. The computer software product of claim 59, wherein the predetermined operations further comprise sorting said files and said file segments in descending order based upon file size.

61. The computer software product of claim 59, wherein the predetermined operations further comprise sorting said files and said file segments in ascending order based upon file size.

62. The computer software product of claim 59, wherein the predetermined operations further comprise concurrently writing said files to said backup devices.

63. The computer software product of claim 59, wherein the predetermined operations further comprise concurrently writing said file segments to said backup devices.

64. The computer software product of claim 62, wherein the predetermined operations further comprise writing said files in accordance with their ordered position in said sorted list.

65. The computer software product of claim 59, wherein the predetermined operations further comprise splitting files larger than said segmentation threshold value to file segments according to space remaining in said backup devices.

66. The computer software product of claim 65, wherein the predetermined operations further comprise attaching a header to each of said file segments.

67. The computer software product of claim 66, wherein said file segment header comprises at least one of an offset field and a size field.

68. The computer software product of claim 59, wherein the predetermined operations further comprise writing said files and said file segments to the then least filled-up backup device.

69. A computer system adapted for parallel backup of at least a file source and at least two backup devices, the computer system comprising:

at least a file source and at least two backup devices interconnected by a communications link;

a memory comprising software instructions adapted to enable the computer system to perform:

calculating a segmentation threshold value; and

directing said files from said file source to said backup devices.

70. The computer system of claim 69, wherein said backup system is geographically distributed.

71. The computer system of claim 69, wherein said software instructions are further adapted to calculate said segmentation threshold value by summing the sizes of all files in said file source and dividing the result by the number of said backup devices.

72. The computer system of claim 69, wherein said software instructions are further adapted to:

split files that exceed said segmentation threshold value into file segments, wherein each of said file segments do not exceed said segmentation threshold value;

sort files located in said file source and said file segments into a sorted list; and

write files smaller than said segmentation threshold value and said file segments into said backup devices according to said sorted list.

73. The computer system of claim 72, wherein said software instructions are further adapted to attach a header to each of said file segments.

74. The computer system of claim 73, wherein said file segment header comprises at least one of an offset field and a size field.

75. The computer system of claim 72, wherein said software instructions are further adapted to sort said files and said file segments in descending order based upon file size.

76. The computer system of claim 72, wherein said software instructions are further adapted to sort said files and said file segments in ascending order based upon file size.

77. The computer system of claim 72, wherein said software instructions are further adapted to concurrently write said files and said file segments to said backup devices.

78. The computer system of claim 72, wherein said software instructions are further adapted to write said files and said file segments in accordance with their ordered position in said sorted list.

79. The computer system of claim 72, wherein said software instructions are further adapted to write said files and said file segments to the then least filled-up backup device.

80. The computer system of claim 69, wherein said software instructions are further adapted to:

sort files located in said file source into a sorted list;

write files smaller than said segmentation threshold value into said backup devices according to said sorted list;

split files larger than said segmentation threshold value into file segments according to space remaining in each of said backup devices; and

write said file segments onto said backup devices.

81. The computer system of claim 80, wherein said software instructions are further adapted to sort said files and said file segments in descending order based upon file size.

82. The computer system of claim 80, wherein said software instructions are further adapted to sort said files and said file segments in ascending order based upon file size.

83. The computer system of claim 80, wherein said software instructions are further adapted to concurrently write said files to said backup devices.

84. The computer system of claim 80, wherein said software instructions are further adapted to concurrently write said file segments to said backup devices.

85. The computer system of claim 83, wherein said software instructions are further adapted to write said files in accordance with their ordered position in said sorted list.

86. The computer system of claim 80, wherein said software instructions are further adapted to split files larger than said segmentation threshold value to file segments according to space remaining in said backup devices.

87. The computer system of claim 86, wherein said software instructions are further adapted to attach a header to each of said file segments.

88. The computer system of claim 87, wherein said file segment header comprises at least one of an offset field and a size field.

89. The computer system of claim 80, wherein said software instructions are further adapted to write said files and said file segments to the then least filled-up backup device.

90. A method for calculating a size threshold in a parallel backup system comprising at least a file source and at least two backup devices, the method comprising:

summing the sizes of all files in said file source; and

dividing the result by the number of available backup devices.

91. The method of claim 90, wherein said parallel backup system is distributed.

92. The method of claim 90, wherein said parallel backup system is geographically distributed.

93. The method of claim 90, wherein said file source a storage device, a hard disk, a random access memory, a programmable non-volatile memory, a redundant array of independent disks (RAID), an incremental backup data, a snapshot data, a file system, a distributed file system or a location independent file system.

94. The system of claim 90, wherein said file source is comprised of at least two independent file sources.